



A.D. 1867, 23rd NOVEMBER. N° 3314.

S P E C I F I C A T I O N

OF

GEORGE DOUGLAS HUGHES.

FURNACES FOR CONSUMING SMOKE.

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A.D. 1867, 23rd *NOVEMBER*. N° 3314.

Furnaces for Consuming Smoke.

LETTERS PATENT to George Douglas Hughes, of Nottingham, in the County of Nottingham, for the Invention of “**IMPROVEMENTS IN THE MEANS OF AND APPARATUS FOR CONSUMING SMOKE AND ECONOMIZING FUEL IN FURNACES OF STEAM BOILERS AND OTHER FURNACES.**”

Sealed the 19th May 1868, and dated the 23rd November 1867.

PROVISIONAL SPECIFICATION left by the said George Douglas Hughes at the Office of the Commissioners of Patents, with his Petition, on the 23rd November 1867.

I, GEORGE DOUGLAS HUGHES, of Nottingham, in the County of Nottingham,
5 do hereby declare the nature of the said Invention for “**IMPROVEMENTS IN THE MEANS OF AND APPARATUS FOR CONSUMING SMOKE AND ECONOMIZING FUEL IN FURNACES OF STEAM BOILERS AND OTHER FURNACES,**” to be as follows :—

This Invention relates to certain improvements in the means of and apparatus for consuming the smoke and gases arising from the combustion
10 of coal or other fuel in steam boiler and other furnaces, whereby smoke is prevented, and fuel, labor, and expense are economized.

I propose to construct the door of the furnace with a series of rising and falling or sliding plates or valves somewhat after the principle of an air

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ventilator; these plates or valves are actuated by a vertical rod or rods worked by a series of clock or weight work, and train of wheels, shafts, pulleys, chains, cords, or other equivalents, in order that the time or period of closing the valves may be regulated so as to admit the proper quantity of air to aid the combustion of the smoke or gases given off from the fuel. I also 5 apply to the shaft a ratchet wheel and one or more catches for the purposes of locking the air apparatus open until the proper time has elapsed for their closing, when the clockwork commences to act on the apparatus, gradually closing the same. For a similar purpose I employ a plain wheel and a locking apparatus with plain rounded end, which acts on any part of the 10 circumference of the wheel and holds it by friction alone until released. The interior of the furnace door is provided with a series of vertical bars or rods forming a species of respirator through which the air passes from the valves, becoming distributed or spread in its traverse, and mingling with the products of combustion. Beyond these vertical rods a series of oblique deflecting 15 plates are fixed to cause the heated air to flow downwards on to the furnace. Within the series of vertical bars a rods two or more diverting plates are arranged in order to cause the current of air to diverge or impinge in various directions over the products of combustion. The apertures in the furnace door may be closed with slides operated by means of a friction wheel or 20 wheels, and opened by a self-acting cam or lever motion. By these arrangements the smoke will be thoroughly consumed, the fuel will be economized, and labor and expense will be saved.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said George Douglas Hughes in the Great Seal Patent 25 Office on the 22nd May 1868.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, GEORGE DOUGLAS HUGHES, of Nottingham, in the County of Nottingham, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters 30 Patent, bearing date the Twenty-third day of November, in the year of our Lord One thousand eight hundred and sixty-seven, in the thirty-first year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said George Douglas Hughes, Her special licence that I, the said George Douglas Hughes, my executors, administrators, and assigns, or such 35 others as I, the said George Douglas Hughes, my executors, administrators,

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and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an
5 Invention for "IMPROVEMENTS IN THE MEANS OF AND APPARATUS FOR CONSUMING SMOKE AND ECONOMIZING FUEL IN FURNACES OF STEAM BOILERS AND OTHER FURNACES," upon the condition (amongst others) that I, the said George Douglas Hughes, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe
10 and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said George Douglas Hughes do hereby
15 declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My Invention has for its object the application of apparatus to the furnace doors of land or marine steam boiler furnaces, or to other furnaces, or to any
20 other suitable part of such furnaces for the purpose of supplying, regulating, and cutting off the air to such furnaces in order to improve the combustion of the solid fuel and gases, to prevent smoke and the radiation of heat outwards.

To effect these objects the furnace doors or other part of the furnace selected is supplied with a door or box provided with moveable shutters or valves, or
25 with a hit and miss slide or grate; these shutters or slides are to be opened immediately after supplying fuel to the furnace or stirring up or stoking the same, these valves, shutters, or slides becoming shut or closed by degrees, gradually after the lapse of a determined period from the firing or stoking the furnace. The period of closing these is regulated by an ordinary pendulum
30 clock, small engine, smoke jack movement, or by any similar equivalent means which may be available for the purpose in connection with gearing acting on such shutters, slides, or valves. The interior of the door or box applied to the furnace for this purpose is fitted with a series of vertical, round, or other shaped wires or rods so arranged that the air shall not have free and uninter-
35 rupted access to the fire without whirling round, and circulating between, and becoming heated by these wires or rods on its entrance to the furnace. I place one, two, three, or more vertical plates on each side of the box, but inclined to the central axis of the furnace in such manner as to cause the

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air to diverge on entering the furnace so as to spread equally across the same from side to side. Also in connection with these bars and diverging plates, I attach to the upper parts of the box or door a deflecting plate or plates fixed at such an angle as shall cause the air to be deflected downwards and impinge upon the fuel more directly. By these means the fuel is supplied with highly 5 heated air whirling and passing into and upon the fuel in the furnace, contributing to the combustion of the fuel and the ignition and consumption of the smoke and gases which would otherwise pass off from the furnace unconsumed. I also make the furnace bars very thin with air spaces between and through them vertically and horizontally, having one, two, three, or more 10 projections along the bottom of the bar, which when the bars are placed in their position in the furnace, form one continuous bar or bars across the fire on the under side; by means of this arrangement I secure a stronger and lighter bar with more air space to contribute to the more efficient combustion of the fuel, whilst the projections forming the bars across the bottom side, 15 cause the air to be obstructed in its ingress, giving it time and directing it upward into the fire. When a series of boilers are working together, I prefer to use a small engine for the driving power, in which case I cause the waste steam from such engine to be conveyed along the fronts of the several boilers across the ash-pits by means of a pipe or pipes. This pipe being perforated, 20 or small pipes being attached to the inside, so as to cause the steam to be blown along the under side of the bars increasing the draught and facilitating combustion of the products of the fuel.

In order that my said Invention may be completely understood, I annex the accompanying Drawings and explanation of the same. 25

Figs. 1 and 2 shew a front elevation of two doors x, x , one fitted with shutters the other with slides. Figs. 3 and 4 are plans of the same; and Fig. 5 is a section through the middle of a door fitted with shutters or valves; Figs. 6 and 7 shew plan and side elevation of regulating lever and friction catch for regulating the closing of the apertures; Figs. 8 and 9 shew two similar views 30 of same with ratchet wheel and pall, with two palls; and Figs. 10 and 11 shew plan and side elevation of the furnace bar; Fig. 12 is a front elevation of a two-flued or Cornish internally fired boiler shewing the apparatus attached and mode of working the same both by clock and steam engine. In each of these Figures the same letters of reference indicate the same parts. I prefer 35 to make the doors or boxes of furnaces with the improved apparatus attached thereto, but the apparatus may be made separately and attached to any existing doors or boxes of furnaces to which it may be suitable or applicable.

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Referring to Figs. 1 and 2, on supplying the furnace with fuel or stoking by raising the lever C or bar D, the slides or shutters B will be raised opening the apertures E for the admission of air; the chains E¹, F¹, attached at V and connected to the overhead motion, T, U, Fig. 12, being raised and stretched
5 by the balance weight on back ends of the levers, the catches L or I will fall into gear and prevent the closing of the shutters or slides until the clock or engine shall have caused the shaft to revolve round, gradually closing the same. A, A, are the closing shutters or valves; B, B, the slides; C the lever connected to slide by means of the rod D; E are the apertures in the door
10 shewing the vertical bars behind; F shews the position of the deflecting plate or plates; G the diverging plates. The same letters in Fig. 5 indicate the same parts.

Figs. 6 and 7 shew plan and side elevation of lever with friction catch, J being the lever, and H the plain wheel, and T the catch.

15 Figs. 8 and 9 shew similar views of lever M with ratchet wheel K and pall L; N represents the balance weight.

Figs. 10 and 11 are plan and side elevation of furnace bar. O, O, are the vertical apertures in the bar and P, P, the lateral openings for the admission of air; R, R, are projections on the under side of the bar forming transverse
20 bars across the under side of the furnace to intercept the air; S, S, the solid sides of the bar; N¹ the solid divisions between the apertures O. A¹, Fig. 12, shews the position of the clockwork; B¹, the engine; I¹, the steam inlet pipe; J¹, the exhaust pipe terminating in the transverse horizontal pipe K¹ perforated with small holes or provided with small exit tubes in order that
25 the rush of steam may increase the draught and aid combustion as before stated.

Having now described the nature of my said Invention, and the manner in which the same is to be carried into practical effect, I would remark in conclusion that I do not limit or restrict myself to the precise details or con-
30 figuration or position of parts which I have expressed and shewn, as the same may obviously be modified without in any degree departing from the principles on which the Invention is based, but what I claim and desire to be secured to me by the herein in part recited Letters Patent is, the peculiar arrangement and application of vertical wires or rods in the door or box or respirator
35 and the projections on the under side of the fire-bars, and also the combination of diverging and deflecting plates. I do not claim any of the other mechanical arrangements separately, but I claim the combined means, apparatus, and general arrangement of parts as applied to the doors or other parts of

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furnaces for the purpose of consuming smoke and economizing fuel substantially as herein specified and shewn.

In witness whereof, I, the said George Douglas Hughes, have hereunto set my hand and seal, this Nineteenth day of May, in the year of our Lord One thousand eight hundred and sixty-eight. 5

GEORGE DOUGLAS HUGHES. (L.S.)

Nottingham.

Witness,

WILLIAM SMITH,
Nottingham.

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